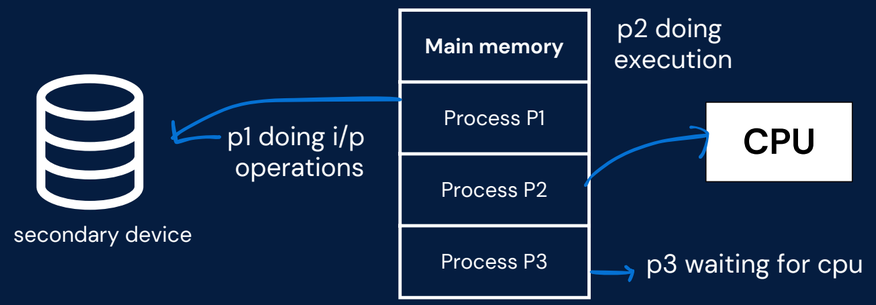
Multiprogramming Operating System



A **Multi-programming OS** allows multiple programs to run at the same time by sharing resources like memory and CPU time. This system maximizes the use of the CPU, keeping it active instead of waiting for one task to finish before starting another. Bascially bring more and more programs and execute them completely so that CPU shouldn't stay idel

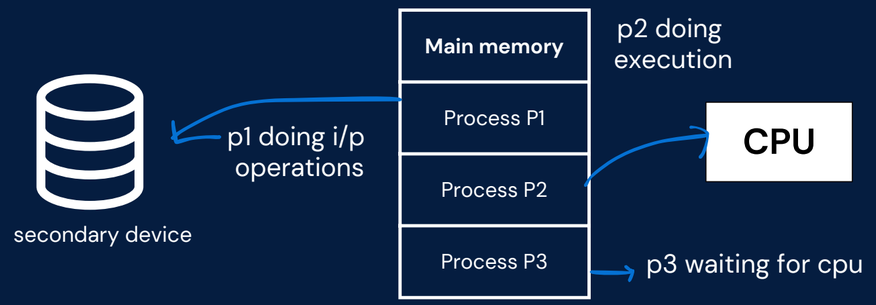
Multiprogramming (Maximizing CPU Usage)

Imagine you are a chef in a restaurant.

- You put pasta on the stove to boil (this takes time).
- While waiting, you start chopping vegetables.
- Once the pasta is done, you start cooking the sauce.

The chef (CPU) switches tasks instead of waiting idly. Similarly, in multiprogramming, the CPU switches between programs when one is waiting for an operation (like disk I/O).

Multiprogramming Operating System



Multiprogramming:

- The CPU switches only when a program needs to wait (e.g., for I/O operations like reading from a disk).
- The goal is to keep the CPU busy by switching to another program instead of letting it sit idle.
- Example: If a program is waiting for input from a keyboard, the CPU switches to another program that can use it.

How it works:

- The OS keeps multiple programs in memory and switches between them.
- When one program waits for something (like reading a file), the CPU switches to another program.

For ex : Older versions of Unix.

Multiprogramming Operating System

- Task 1: Writing a document in Microsoft Word.
- Task 2: Downloading a large file from the internet.
- Task 3: Playing a song in the background.
- Task 4: Printing a document.

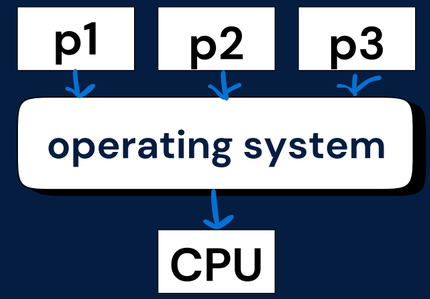
If Multiprogramming is not there:

We have to wait for the file to finish downloading before we could type,
or for the printer to finish before playing the song.

Tasks would execute sequentially, wasting time and underutilizing the CPU.

Time	Active Task on CPU	I/O in Progress
T1	Typing in Microsoft Word	Downloading file from the internet
T2	Playing a song	Printing the document
T3	Resuming typing	Download continues
T4	Sending data to printer	Song playback continues

Multitasking Operating System



A **Multi-tasking OS** lets a user run multiple tasks at once by quickly switching between them, so it seems like everything is happening at the same time. It makes the computer feel faster and more responsive to the user, allowing them to perform many tasks at once, like watching a video while typing or checking email.

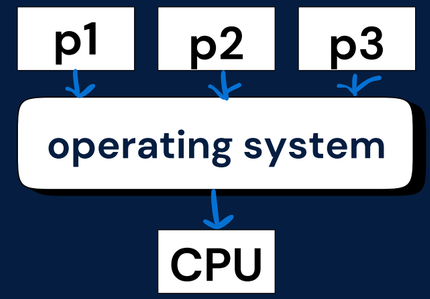
Multitasking (Fast Switching for User Experience)

Now imagine you are working on a laptop:

- You are watching a video, downloading a file, and typing a document at the same time.
- The operating system rapidly switches between these tasks, making it feel like everything is happening at once.

The CPU gives tiny time slots to each task so fast that you don’t notice the switching. This is multitasking—allowing multiple tasks to run "simultaneously" by quickly switching between them.

Multitasking Operating System



Multitasking:

- The CPU is forced to switch tasks at fixed time intervals, even if the current task isn’t waiting.
- The goal is to provide quick responsiveness so multiple tasks appear to run at the same time.
- Example: When watching a YouTube video while writing a document, the OS rapidly switches between these tasks so both seem to run together.

How it works:

- The OS allocates small chunks of time to each task, rapidly switching between them.
- For example, you might have a web browser, music player, and word processor open, and the OS switches between them so fast you don’t notice.

For ex : Windows, macOS, and Linux.